TYPES AND DETAILS OF BRIDGE CONSTRUCTION

PART I. ARCH SPANS.

EXAMPLES OF CONSTRUCTED WOODEN, COMBINATION, WROUGHT IRON AND STEEL ARCHES FOR HIGHWAY AND RAILROAD BRIDGES.

A collection of essential features of special and important work, illustrating variety of design, development of standard practice and methods of erection.

Recorded and Classified for Students, Instructors. Designers, Engineers, Architects and Contractors.

By FRANK W. SKINNER, M. Am. Soc. C. E.
Consulting Engineer.
Associate Editor The Engineering Record.
Non-Resident Lecturer on Field Engineering at Cornell University.

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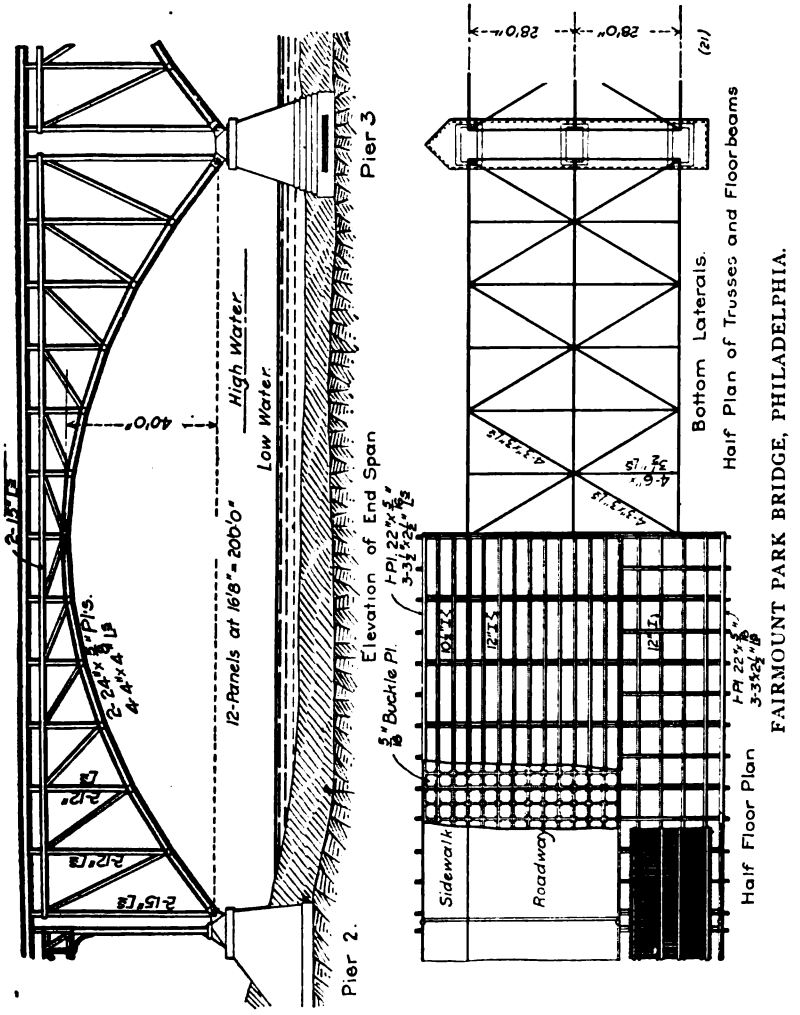
CHAPTER IV.

FAIRMOUNT PARK, MENOMINEE AND SALMON RIVER BRIDGES. SPANS 200 TO 270 FEET.

The highway bridge over the Schuylkill River in Fairmount Park, Philadelphia, has four spandrel-braced, three-hinge arches



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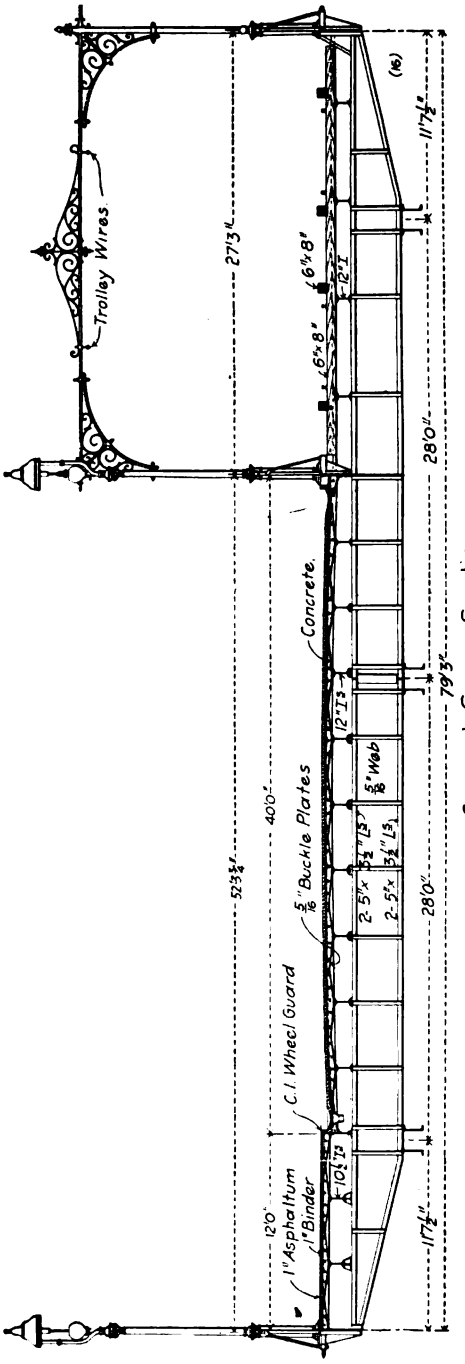


General Cross-Section.

FAIRMOUNT PARK BRIDGE.

of 200-foot span and 40 feet rise on centers of pins. It has three trusses which are 28 feet apart on centers, and 6 feet deep at the crown. It is 76 feet wide in the clear between hand-rails, has a grade of 1.20 per cent and a maximum height of about 76 feet from roadway to low-water level. The estimated steel weight and cost were about 6,000,000 pounds and $375,000, including superstructure. It is made of medium steel, and the heights of the successive spans increase 7½ feet on account of grade.

The floorbeams and stringers are proportioned to carry a loading of 100 pounds per square foot over all parts of the sidewalk and driveway, or a 20-ton load on a wheel-base of 9 feet, on any part of the driveway, and for 1000 pounds per linear foot of the railroad tracks, or an electric car weighing 25 tons loaded followed by another car weighing 20 tons loaded, on a total wheel-base of 78 feet.

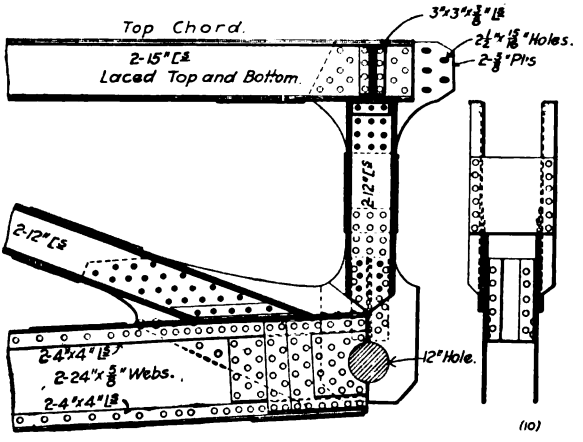
The trusses carry the full area of the sidewalk and driveway over the whole span loaded with 80 pounds per square foot, and 1,000 pounds per linear foot over each railroad track.

Each truss has twelve equal panels, and all its members are made of pairs of channels, latticed on both flanges. The bottom chord has a uniform section throughout, made of two built channels, each composed of one 24 x ⅝-inch web-plate and two 4 x 4-inch flange angles. All other members are made of rolled channels 12 or 15 inches deep. All truss joints are made with double gusset plates shop-riveted to the chords and field-riveted to the web members. The crown hinge is made with a 12-inch pin, having half holes in the lower chords and full holes in the gusset plates. The abutting ends of the lower chords have a wider clearance at the bottom than at the top edges, so that the inclined faces make angles of about 3 degrees and 49 minutes each with the vertical. The gusset plates at the center joint of the top chord are shop-riveted to one chord and bolted through slotted holes in the other chord, so as to make an expansion joint. The 10-inch skewback hinge pins have half-hole bearings in the ends of the lower chords, and are locked to the pedestals by full holes in the gusset plates.

The trusses are braced together by the solid steel-plate floor system, by vertical transverse sway bracing at every panel point, and by the lower chord lateral system, which consists of horizontal transverse struts at all panel points and X-bracing in double panels. All of the lateral struts and diagonals have I-shape cross sections made of two pairs of angles back to back latticed. At

the center six panel points, the sway bracing consists of intersecting zigzag angles latticed between the bottom strut and the floorbeam, virtually making lattice girders. Elsewhere it consists of X-bracing of single angles in the panels made by the vertical posts, floor beams and bottom transverse struts. The floorbeams are plate girders 3 feet deep and 79¼ feet long over all. They are seated across the top chords at panel points, and the ends are tapered to a point beyond them where they form cantilever brackets, with a clear overhang of nearly 11 feet.

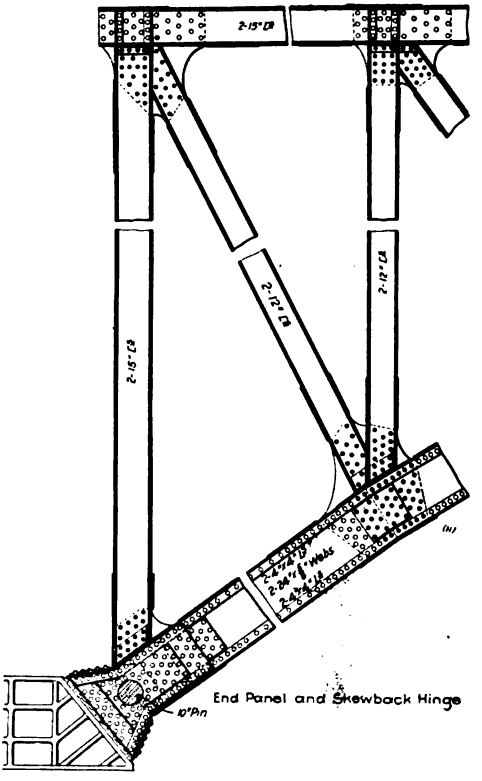
They carry the roadway on nine lines of 12-inch, 120-pound I-beams, 4 feet apart. Each of the two street car tracks is carried on two lines of 12-inch, 120-pound I-beams 6 feet apart. The sidewalk has two lines of 10½-inch, 76½-pound I-beams. There



Center Panel and Crown Hinge.

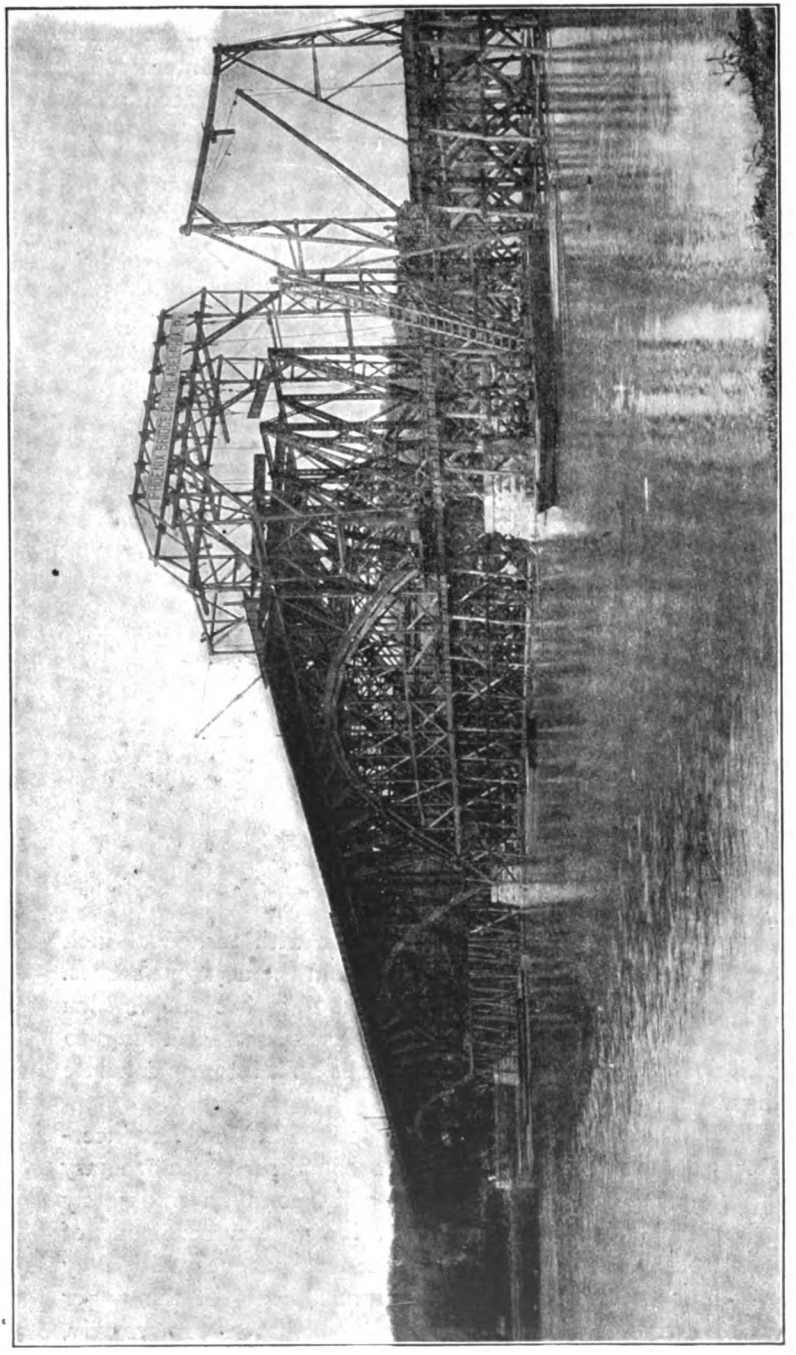
are plate girders for the curbs and for fascia girders at the ends of the floorbeams, the latter having transverse vertical plates riveted to their web stiffeners to make knee braces for the hand-rail posts. The roadway and sidewalk stringers are seated on cast-iron chairs to give them the proper elevation and crown. They are covered by buckle plates in transverse strips riveted to them convex side up. They are leveled up with concrete covered with 1 inch of binder. This is finished with asphaltum, which is 1 inch thick for the sidewalk and 2 inches thick for the roadway. The hand-rail has cast-iron posts and gas-pipe frame, and there are ornate cast-iron lampposts both sides of the trolley tracks, to carry ornamental portals of steel scrollwork, from which the trolley wires are supported.

The skewback pins engage riveted steel pedestals, which have bases normal to the lower chord end sections, and are bolted to cast steel seats on the masonry piers. On the intermediate piers these seats are large, hollow boxes with braced webs.



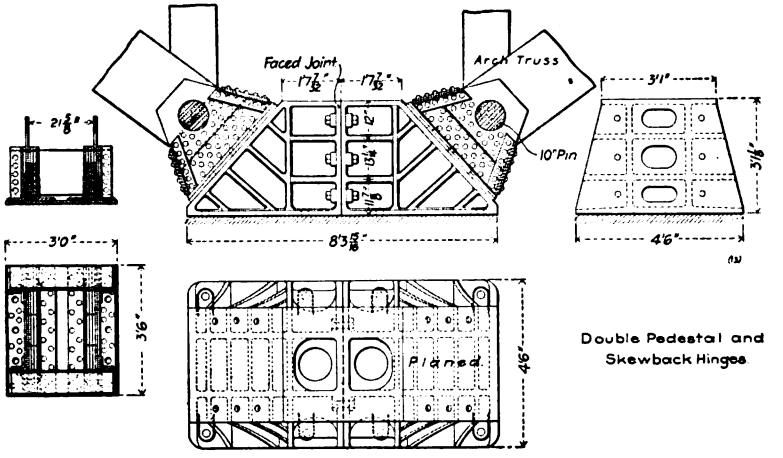
They are made in halves bolted together with turned $1\frac{3}{4}$-inch bolts, and receive the balanced thrusts from the adjacent arches. They are seated on 7 x 10-foot base plates $1\frac{1}{2}$ inches thick, which are anchored with six $2\frac{1}{2}$-inch vertical bolts about 20 feet long, to a reaction platform of crossed tiers of rails built into the concrete footings.

The erection of the bridge was described in "The Engineering Record" of June 4, 1898, and was accomplished with ordinary fixed trestle falsework. The bents correspond approximately with the panel points, and each had a lower story consisting of eight piles cut off 22 feet above water-level, above which they were X-braced transversely. The framed bents of the upper story each consisted of three vertical posts X-braced transversely,



ERECTION OF 200-FOOT SPANS ACROSS THE SCHUYLKILL RIVER, FAIRMOUNT PARK.

and supporting the lower chords by cross pieces and camber wedges on double lines of inclined stringers parallel to them and notched over their caps. The pile caps projected 9 feet beyond



the upper falsework on each side, to carry the standard-gauge traveler tracks. Alternate panels of the falsework were X-braced longitudinally to make towers.

The wooden traveler had a strident two-bent tower about 84 x 50 x 72 feet in extreme dimensions. It had a clearance about 60 feet wide and 62 feet high. The tops of the braced posts were connected by and braced to combination Howe trusses 10 feet deep and 80 feet long, from which hoisting tackles could be suspended. These trusses supported a cantilever overhang 23 feet long on the rear side of the traveler, which was proportioned for a 10,000-pound load at the extremity. Guyed working platforms were cantilevered out from the outsides of the traveler posts just above the tracks. Material was delivered on top of the finished structure, and the traveler receded from it after setting the long floor-beams and stringers in place from its overhang.

The single-track deck bridge of the Superior Division of the Chicago, Milwaukee and St. Paul Railway, across the Menominee River, near Iron Mountain, Michigan, replaces a deck Pratt truss bridge of 225-feet span which had become too light for the service. It has short plate girder approaches and a 207-foot skew three-hinge spandrel-braced main arch span, with a rise of about 46 feet, center to center of crown, and skewback pins, and about 52 feet, center to center of top and bottom chords. The trusses are 22 feet apart on centers, and are connected by transverse